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### (54) Transducer protection device, particularly for hemodialysis processes

(57) A transducer protection device, particularly for hemodialysis processes, which comprises a first element (2) and a second element (3) made of plastics which are coupled coaxially with respect to a common axis (A) and respectively comprise a first tubular connector (4) and a second tubular connector (5) which are blended with respective flanges (6,7) which are coaxial to the common axis (A); the flanges (6,7) are coupled to each other along their peripheral region by ultrasonic thermal bonding; the device has a recess (8) formed

frontally on a first one (6) of the flanges, the recess (8) being coaxial to the common axis (A) and being suitable for accommodating, in a fixed arrangement, a semipermeable membrane (15) by imbibition of melted plastics along a circular border region (25) by the thermal bonding provided on a circular ridge (20) which is shaped complementarily to the border region (25) and protrudes frontally from the second flange (7) so as to achieve bonding between the first (6) and second (7) flanges and the membrane (15).

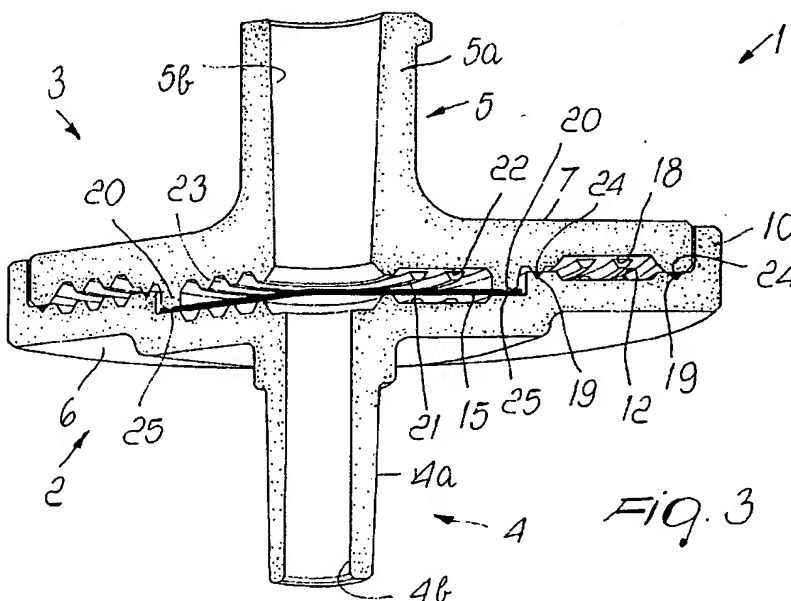


Fig. 3

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## Description

[0001] The present invention relates to a transducer protection device, particularly for hemodialysis processes, suitable for measuring the blood pressure in the patient during hemodialysis.

[0002] It is known that in this field one of the strongly felt problems is to prevent the blood pressure measurement device from becoming infected by any virus present in a patient which may be transmitted to a subsequent patient, to operators and even to the entire hemodialysis machine.

[0003] In particular, it has been found that the protective devices currently in use consist of elements which, through ducts, are connected at one end to a main duct, which connects the patient to the hemodialysis machine, and at the other end to another duct which leads to a blood pressure measurement device. Said elements comprise two tubular connectors made of plastics being connected to the ducts. The two tubular connectors blend with two respective circular flanges between which, during sealing, a membrane of semipermeable material is interposed, which is suitable for retaining the liquids and/or the viruses present in said liquids. The membrane covers the entire circular surface of the two flanges and is fixed thereon during the sealing/gluing of the flanges.

[0004] Although this solution solves the problem of protection from viral infections, it requires considerably complex operations for construction, with consequent damage risks to the membrane, and moreover it does not ensure the necessary tightness of the membrane between the flanges.

[0005] The aim of the present invention is to obviate said drawbacks by providing a transducer protection device which allows excellent membrane tightness.

[0006] Within the scope of this aim, an object of the present invention is to ensure protection against viral particles for the pressure measurement device and for the hemodialysis machine, as well as for the patient and the health operators.

[0007] Another object of the present invention is to provide a structure which is simple, relatively easy to be manufactured, safe in use, effective in operation and has a relatively low cost.

[0008] These and other objects are achieved by the present transducer protection device, particularly for hemodialysis processes, which comprises a first element and a second element made of plastics which are mutually coupled coaxially with respect to a common axis and respectively comprise a first tubular connector and a second tubular connector blended with respective flanges which are coaxial to said common axis, said flanges being coupled to each other along their peripheral region by ultrasonic thermal bonding, said device being characterized in that a recess is formed frontally on a first one of said flanges, said recess being coaxial to said common axis and being suitable to accommo-

date, in a fixed arrangement, a semipermeable membrane by imbibition of melted plastics along a circular border region by way of the thermal bonding provided on a circular ridge which is shaped complementarily to said border region and protrudes frontally from the second flange so as to achieve bonding between said first and second flanges and said membrane.

[0009] Further particularities will become better apparent from the detailed description of a preferred but not exclusive embodiment of a transducer protection device, particularly for hemodialysis processes, according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the device according to the invention;

Figure 2 is a sectional view, taken along a plane which contains the longitudinal axis during preassembly;

Figure 3 is a sectional view, taken along a plane which contains the longitudinal axis, in which the flanges are coupled;

Figure 4 is a view of another embodiment of the circular ridge that protrudes from the second flange.

[0010] With reference to the above figures, 1 generally designates a transducer protection device particularly for hemodialysis processes according to the invention.

[0011] The device 1 comprises a first element 2 and a second element 3 which are coupled coaxially with respect to a common axis A.

[0012] Each one of the two elements 2 and 3 has a first tubular connector 4 and a second tubular connector 5, respectively, which are coaxial to the common axis A and blend with respective flanges 6 and 7.

[0013] The first connector 4 is externally provided with a frustum-shaped surface 4a inside which a cylindrical channel 4b is provided. The cylindrical channel 4b is connected to a lead, not shown in the accompanying drawings, by interlock coupling with said first connector 4. Finally, the lead leads to a pressure gauge at one of its ends.

[0014] The second tubular connector 5 is externally provided with a cylindrical surface 5a inside which there is a duct 5b having a conical cross-section and receiving a hose by interlock coupling, not shown in the accompanying drawings, which arrives from a main hose which conveys the blood to the hemodialysis machine.

[0015] The first flange 6 is frontally provided with a circular recess 8 coaxial to the common axis A. As a concentric extension of the recess 8 a flat annular seat 9 is provided from which a lip 10 rises peripherally and perimetrically encloses the seat 9. At a median region of the seat 9 there are circular grooves 11 crossed in a radial pattern by radial grooves 12 which are spaced from each other by a quarter turn.

[0016] The recess 8 has, at an annular median region,

a plurality of circular channels 13 which are crossed in a radial pattern by radial channels 14 being spaced from each other by an angle of 90°. Finally, the recess 8 accommodates a circular membrane 15 whose laying and fixing methods are specified hereafter.

[0017] The second flange 7 is frontally provided with an annular cavity 16 which is coaxial to the common axis A and on which there are further circular grooves 17 which are crossed in a radial pattern by other radial grooves 18 being spaced from each other by a quarter turn. The annular cavity 16 is enclosed by edges 19 whose cross-section, along a longitudinal plane containing the common axis A, is pointed.

[0018] Continuing radially toward the center, there is a circular ridge 20 which forms a circular cylindrical cavity 21 which is coaxial to the common axis A. At the bottom 21a there is another plurality of circular channels 22 crossed radially by other radial channels 23 being spaced from each other by 90°.

[0019] After the arrangement of the membrane 15 in the recess 8, the second flange 7 is keyed in the seat 9 so that the ridge 20 rests on the border region 25 and the edges 19 rest on contacts 24.

[0020] The sealing of the two flanges 6 and 7 and the fixing of the membrane 15 between said flanges are achieved by ultrasonic thermal bonding, acting respectively at the contacts 24 and at the border region 25.

[0021] Thermal bonding at the border region 25 causes the membrane 15 to be imbibed by the melted plastics, thus providing an intimate bonding between the flanges and the membrane.

[0022] The thermal bonding performed at the contacts 24 causes, in this case also, the plastics to melt and therefore causes an intimate mutual coupling of the two flanges, so as to reinforce the seal of the membrane between said two flanges.

[0023] In practical operation, the blood arrives, through the second connector 5, at the cylindrical cavity 21 and diffuses therein through the other plurality of circular channels 22 and radial channels 23, so as to facilitate uniform distribution of the pressure applied to the membrane 15, which in addition to acting as a pressure measurement transducer is made of a semipermeable material which prevents the passage of virus-infected particles to the pressure gauge.

[0024] It has thus been shown that the invention achieves the proposed aim and objects.

[0025] In particular, the fact is stressed that the imbibition of the melted plastics by the membrane allows intimate bonding between the flanges and the membrane, so that a better seal is achieved.

[0026] Furthermore, imbibition allows to limit the risks of membrane damage.

[0027] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0028] Conveniently, as shown in Figure 4, on the second flange 7 there is another embodiment of the circular

ridge 20 which has a triangular cross-section whose height increases from the inner peripheral region toward the outer peripheral region of the annular ridge 20.

[0029] Moreover all the details may be replaced with other technically equivalent ones.

[0030] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the protective scope of the appended claims.

[0031] The disclosures in Italian Patent Application No. B099A000602 from which this application claims priority are incorporated herein by reference.

[0032] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

## Claims

1. A transducer protection device, particularly for hemodialysis processes, comprising a first element (2) and a second element (3) made of plastics which are coupled to each other coaxially with respect to a common axis (A) and respectively comprise a first tubular connector (4) and a second tubular connector (5) which are blended with respective flanges (6,7) coaxial to said common axis (A), said flanges (6,7) being coupled to each other along their peripheral region by way of ultrasonic thermal bonding, said device being characterized in that a recess (8) is formed frontally on a first one (6) of said flanges, said recess (8) being coaxial to said common axis (A) and being suitable to accommodate, in a fixed arrangement, a semipermeable membrane (15) by imbibition of melted plastics along a circular border region (25) by way of the thermal bonding performed on a circular ridge (20) which is shaped complementarily to said border region (25) and protrudes frontally from the second flange (7) so as to achieve intimate bonding between said first (6) and second (7) flanges and said membrane (15).
2. The device according to claim 1, characterized in that an annular seat (9) is provided as a concentric extension of said recess (8) and is peripherally enclosed by a lip (10).
3. The device according to claims 1 and 2, characterized in that said seat (9) is suitable for complementarily receiving said second flange (7).
4. The device according to claim 1, characterized in that said second flange (7) is frontally and peripherally provided with an annular cavity (16) which is

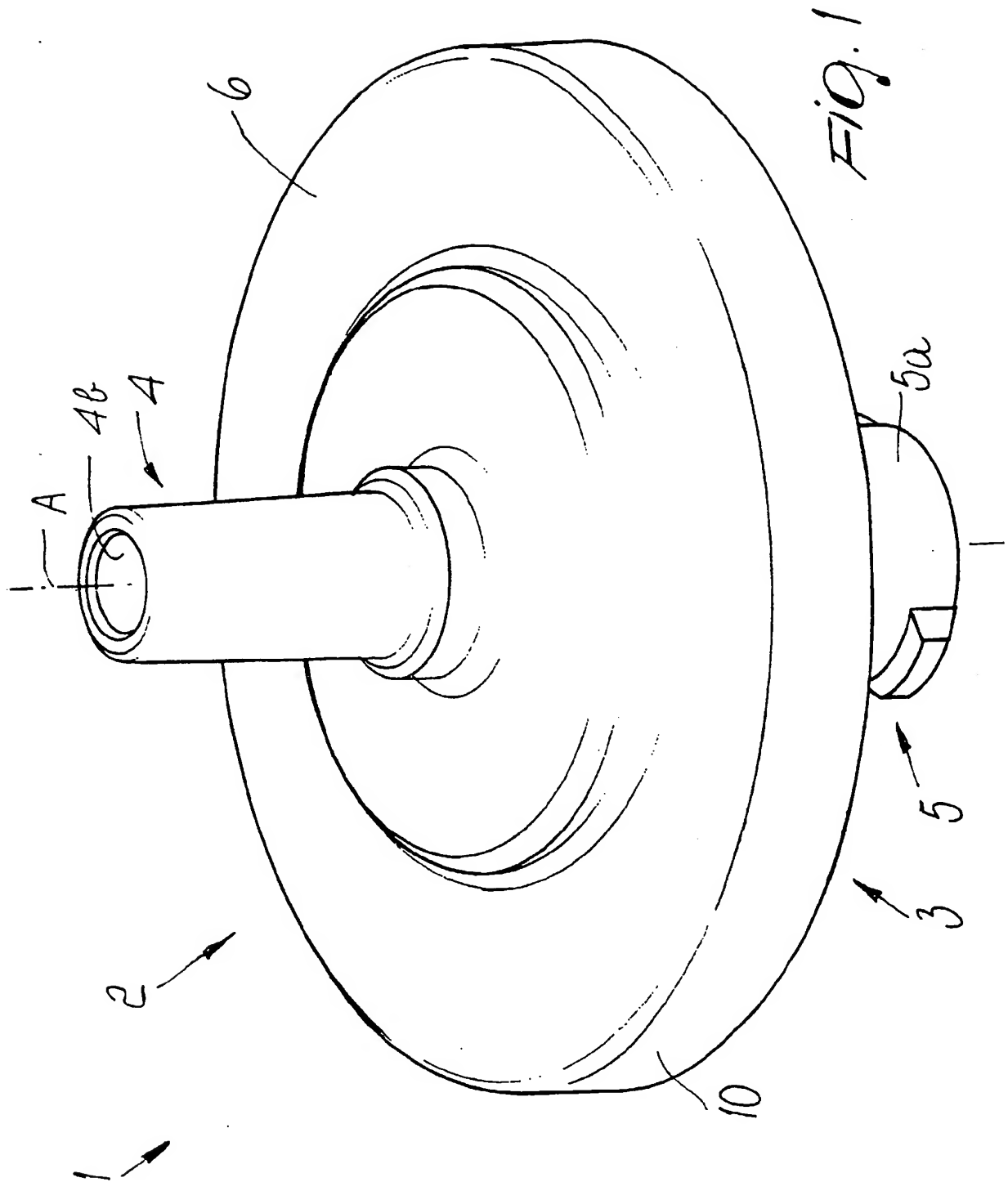
coaxial to said common axis (A) and is enclosed by edges (19) having a pointed longitudinal cross-section.

5. The device according to claim 1, characterized in that said second flange (7) is frontally and centrally provided with a cylindrical cavity (21) which is coaxial to said common axis (A) and is enclosed by said ridge (20). 5
6. The device according to claim 1, characterized in that at the bottom of said recess (8) a plurality of circular channels (13) which are coaxial to said common axis (A) and of radial channels (14) which are spaced from each other substantially by a quarter turn, are provided. 10
7. The device according to claims 1 and 5, characterized in that, at the bottom of said cylindrical cavity (21), a plurality of circular channels (22) which are coaxial to said common axis (A) and of radial channels (23) which are spaced substantially by a quarter turn, are provided. 15
8. The device according to one or more of the preceding claims, characterized in that said channels (22,23) are suitable for facilitating the diffusion of the blood in said cylindrical cavity (21) and the uniform distribution of blood pressure on said membrane (15). 20
9. The device according to one or more of the preceding claims, characterized in that said edges (19) are designed to intimately bond with said first flange (6) by ultrasonic thermal bonding in order to seal said first (6) and second (7) flanges thus coupled. 25
10. The device according to one or more of the preceding claims, characterized in that said ridge (20) is provided with an edge having a triangular cross-section. 30

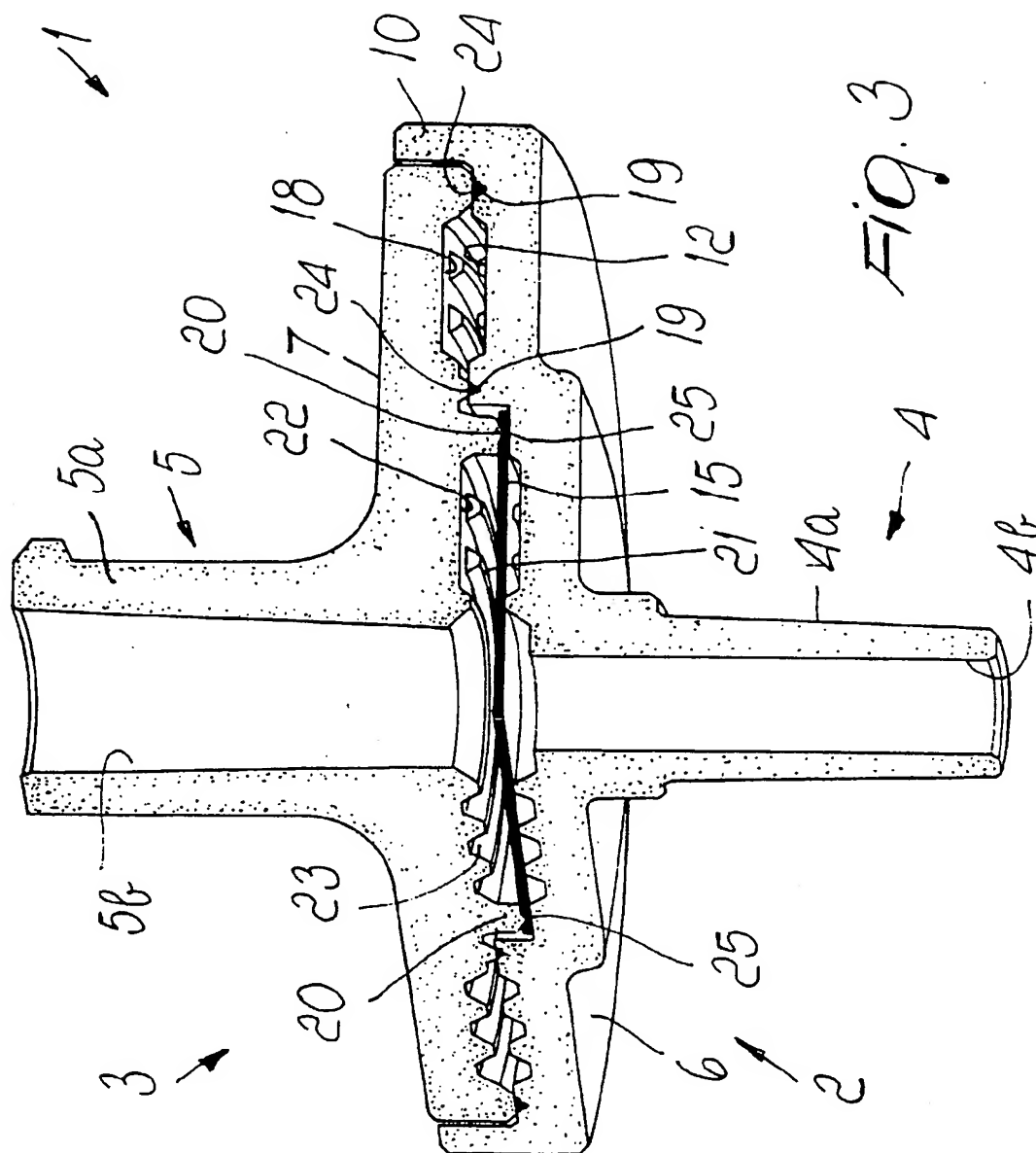
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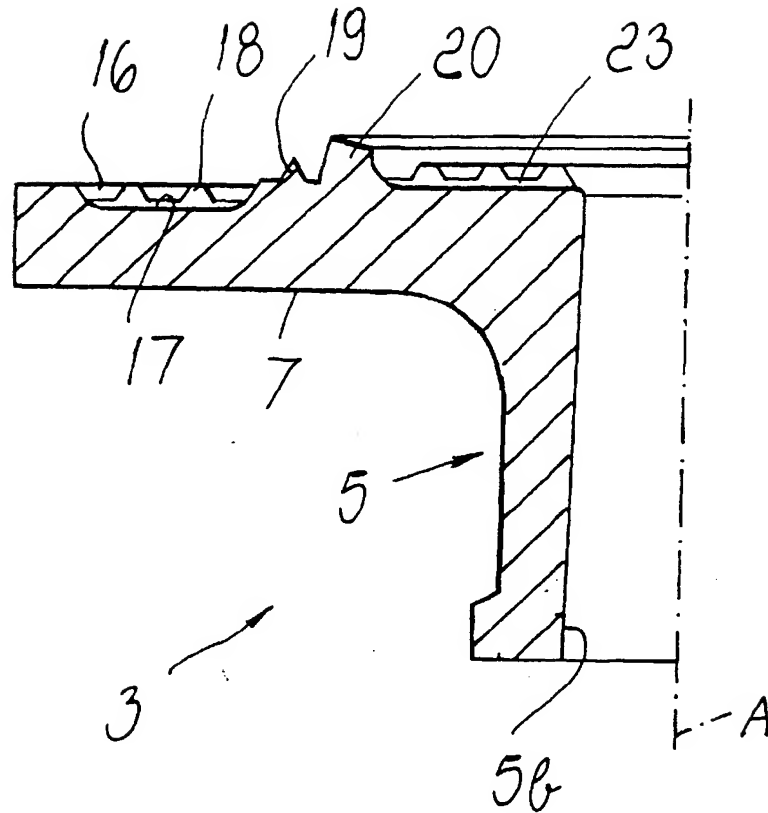
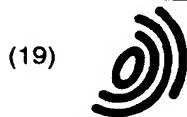


Fig. 4





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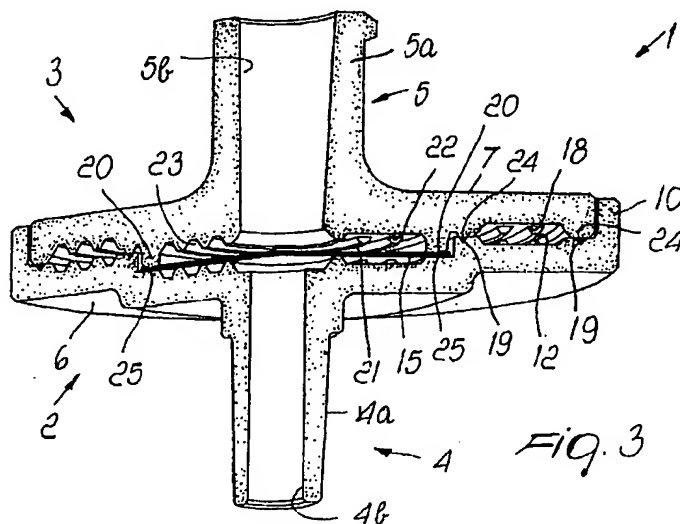


Fig. 3



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Application Number  
EP 00 10 9155

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The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 23 January 2002	Examiner Weihs, J
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document	
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